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Provisional chapter

Introductory Chapter: A Common Feature of Neurodegenerative Disorders

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1. Introduction

The neurodegeneration is a common feature of different disorders, and many partners are involved in this mechanism. The last effect of degeneration is normally observed in the spine defects: reduction of spine density and alteration of morphology or functionality. The degeneration of neuron activity normally leads to the complete cell death.

The most neurodegenerative disorders are essentially affected by neurodegeneration of spine density and functionality, but the initial step or the trigger point is different from each other. Neurodevelopmental disorders or neurodegenerative disease related to the age affects patients in different ways but with the same effect. For this reason, a neurodegeneration is normally an intriguing topic for all scientific communities. Some of the molecular pathways involved in neurodegeneration associated to the most common neurodegenerative disorders are listed below.

2. Accumulation of protein

The aggregation of protein is normally considered a common feature of neurodegeneration. This accumulation leads to neurotoxicity and neuronal death. The causes of protein accumulation are different, but normally most of them are essentially due to mutation of regulation regions of gene (5'UTR, 3'UTR, etc.). Epigenetic mechanism occurs in regulation of protein synthesis, and accumulation of aggregated protein is a consequence Mus L et al., 2019; Sorrentino za et al 2019; Joppe K et al., 2019.

3. Axonal degeneration

Communication from cell bodies to the peripheral spines happens due to the neuronal axon. Various insults may compromise this communication and deteriorate the neuronal axons: trauma, blockade of neuronal transport, or chemical toxicity. The normal trauma associated to axonal degeneration is nerve injury or some stroke. Protein involved in axonal transport deficit or accumulation of protein may also contribute to the axonal degeneration Correale et al., 2019.

4. Mitochondria dysfunction

Mitochondria are important organelles for cells, regulating the cell homeostasis. These organelles contribute to the cell energy, and alteration of one of their function may affect cell life.

Normally, brain senescence and neurodegeneration occur with mitochondrial dysfunction by impaired electron transfer and oxidative damage Cowan K et al., 2019.

5. Apoptosis alteration

Apoptotic cell pathway is a defense mechanism for neurons. Alteration of this system-induced neuronal loss in developing brain affects normal function of neuronal cells, leading to neurodegeneration.

DNA damage is also a common feature of apoptotic pathway, but when this pathway is altered, neuronal defect occurs and, as a consequence, neurodegenerative cell profile D'amelio et al, 2011.

6. Protein synthesis

Some mRNA are transferred locally at synapses and translated upon stimuli, when the protein is necessary. The alteration of global protein synthesis machinery locally at synapses is an important scenario of neurodegeneration and the main cause of different neurodevelopmental disorders Wong yl et al., 2019.

7. Alteration of receptor functionality

The neurons communicate with other neuronal cells through neurotransmitters. The neurotransmitters are released from presynaptic boutons to the postsynaptic compartments which are recognized by receptor. The neuronal receptors are classified as inhibitory and

excitatory, and for this reason different effects are observed in neuron functionality. Mutation or alteration of neurotransmitters affects receptor functionality and neurodegenerative effect.

8. microRNA

Epigenetic mechanism affects cell activity and functionality. Recently, some papers demonstrate a functional role of microRNA in regulation of gene expression. The alteration of microRNA machinery alters gene expression and affects neuronal function Dardiotis E et al., 2018; wang xh et al., 2018.

9. Probably microglia and inflammation

Activation of inflammatory pathway generates a neuronal cascade molecule activation following the external stimuli. The inflammatory pathway is also responsible of synaptic pruning with the elimination of immature and nonactive spines. When this system is altered, many of neuronal activities are affected and neurodegeneration occurs.

The study of different molecular pathways of synaptic plasticity is one of the most intriguing mechanism to identify how neuronal works and intervene in neurodegenerative cases. Most of the neuronal diseases are linked to the neurodegeneration. For this reason, the study of this mechanism is essentially important in the field of neuroscience and is necessary to intervene in case of pathology Paasila pj et al., 2019.

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